being only about 1½*d.* per head of the children of school age." It was also urged that the education given had been a "great deal too literary," and that the "whole training had not been sufficiently scientific and practical." The proposal was supported by two or three members and opposed by others who are well acquainted with India and with educational problems, and it was pointed out that "it was a bad thing too frequently to pull up a plant by its roots to see how it was growing." Mr. Hobhouse, who replied on behalf of the Under-Secretary of State for India, had no difficulty in showing that the request for a committee of inquiry was unnecessary. He assured the House that educational questions had within the past few years been thoroughly investigated and discussed in India by various conferences, commissions, and committees, that the educational system had been recently thoroughly overhauled and re-modelled, and that it is now on more practical and thorough lines than formerly, and that special attention had been paid to primary, secondary, and technical education. Also that the expenditure on education had been almost doubled within the last ten years, and that every effort would be made to increase this expenditure, due consideration being given to other pressing wants in the country. He assured the House that the Secretary of State for India was in fullest sympathy with the object which those proposing the motion had in view, but he was unable to accede to the request, "because the work of education in India had progressed and was steadily being pushed forward, and any inquiry of the sort suggested would not really expedite it." The motion was then withdrawn.

WHEN the British Association met in Bristol ten years ago, Sir Norman Lockyer referred at the closing meeting to the fine educational establishments of the city, and expressed the hope that at some future meeting the association would find Bristol at the head of some great south-western university. Since that time the movement for a University of Bristol has made substantial progress, and frequent references have been made to it in these columns. An important meeting was held at Bristol on April 25 under the auspices of the Bristol and District Workers' Educational Association, when an earnest appeal on behalf of the scheme for a university for Bristol was made by the Bishop of Hereford, the president of the University College. Dr. Percival said he was not sure that the people of Bristol at large had really grasped the extent of the advantages which would accrue to the city in connection with the establishment of a university for Bristol and the west of England. Bristol claims to be the "lantern of the west," and if she is to maintain that claim in future and to maintain her position in the forefront with all the other great cities of England, all grades of citizens must unite in the endeavour to crown their system of educational institutions by the establishment of a university. As local patriots he appealed to them to give their sympathy and their efforts in support of the movement. He put this question to himself, "Why should not I, as a citizen of Bristol, be able to claim as much as if I belonged to Liverpool, Manchester, Sheffield, Leeds, or Birmingham?" Every one of those great cities has secured its university. But the question may naturally be asked, "What are we to gain by a university?" He said he could answer that question in almost a single word. We need only look at a country like Scotland to see what is gained by the possession of popular universities. The population of Scotland is only about 4½ millions, and Scotland has its four ancient universities. If any part of the kingdom or the Empire has profited more by education than all the rest it is Scotland, and Scotland owes its preeminence to the fact of its having enjoyed and made use of those four universities. If we turn from Scotland, Wales is close behind, and has profited immensely by her university colleges and national university. Then in Ireland we are beginning to multiply the universities, and should the citizens of Bristol be content to stand aside? He assured them from a long experience that nothing they could do in Bristol would be better for the education and the future well-being of the working classes of the city than that they should use their best efforts to secure a university.

SOCIETIES AND ACADEMIES.

LONDON.

Chemical Society, April 2.—Sir William Ramsay, K.C.B., F.R.S., president, in the chair.—Rate of hydrolysis of chloroacetates, bromoacetates, and α-chlorohydrin by water and by alkali, and the influence of neutral salts on the reaction velocities (preliminary note): G. **Senter.** The results of an investigation of the rate of displacement of halogen by hydroxyl for bromoacetic acid, its sodium salt, and for α-chlorohydrin, and the effect of certain neutral sodium salts on the reaction velocities are given. These confirm the view that the effect of neutral salts is mainly due to their action on the reacting substances, and appear to be incompatible with the hypothesis advocated by Armstrong and his co-workers, that neutral salt action is due to combination between salt and solvent, with consequent concentration of the solution.—The constituents of Cyprus origanum oil. Isolation of a new terpene, "origanum": S. S. **Pickles.** The oil consists mainly of carvacrol. There are also present (1) a hydrocarbon, $C_{10}H_{16}$, apparently a new terpene, for which the name *origanene* is proposed (2·5 per cent.); (2) cymene, which, together with associated terpenes, constitutes 8·5 per cent.; (3) terpene alcohols (3·5 per cent.); and (4) high boiling residue (1·3 per cent.), besides very small quantities of a second phenol, and probably *iso*butyric acid. Origanene is probably $\Delta^{1:3}$-p-*menthadiene*.—The displacement of halogen in *l*-phenylchloroacetic acid by hydroxy- and methoxy-groups. A contribution to the chemistry of the Walden inversion: A. **McKenzie** and G. W. **Clough.**—The condensation of epichlorohydrin with phenols: D. R. **Boyd** and E. R. **Marle.** The condensation product of phenol and epichlorohydrin is glyceryl diphenyl ether, and not phenyl glycide ether, as Cohn and Plohn suggested. Similarly, the crystalline compound obtained from *p*-cresol and epichlorohydrin is glyceryl di-*p*-tolyl ether.—A new general method of preparing diazonium bromides: F. D. **Chattaway.** Primary aromatic hydrazines react quantitatively with the diazonium perbromides, producing diazonium bromides.—The absorption spectrum of triphenylmethane: A. G. G. **Leonard.** The cause of the difference between the absorption curve plotted by Hartley in 1887 and that plotted by Baker in 1907 is shown to be due to the presence of an impurity in the sample originally examined.—The nature of the impurity found in preparations of triphenylmethane: W. N. **Hartley.** The impurity referred to in the preceding paper appears to be triphenylmethyl.—The constitution of coordinated compounds: S. H. C. **Briggs.** The existence of the two compounds $(Pt6NH_3)Cl_4$ and $(PtCl_6)K_2$, in which the platinum atom is the basis of a complex cation and anion respectively, suggests the view that the platinum atom has both positive and negative affinities, and formulæ giving expression to this view are suggested and discussed.—A combined stop-cock and capillary connecting tube for gas burettes: A. E. **Hill.** The apparatus is figured and described in the original.—The hydrolysis of amygdalin by emulsin, part i.: S. J. M. **Auld.** It has been shown that Jorissen and Hairs's "emulsin" is really a mixture of two enzymes, viz. true emulsin and a maltase-like ferment, and the effect of varying the concentration of amygdalin and emulsin has been investigated, as also the action of many inhibitants.—Complex nitrites containing potassium and lead (preliminary note): A. N. **Meldrum.**—The composition and formula of Wells's potassium lead periodide: A. N. **Meldrum.**—The molecular complexity of amides in various solvents: A. N. **Meldrum** and W. E. S. **Turner.** Determinations of the molecular complexity of eleven amides in various solvents confirm the Nernst-Thomson theory that the smaller the dielectric constant of the solvent the greater is the association of the solute.—The optical activity of compounds having simple molecular structure: W. J. **Pope** and J. **Read.** Chlorosulphoacetic acid and chlorobromomethanesulphonic acid each contain an asymmetric carbon atom in the molecule, but, although their strychnine and quinidine salts crystallise well, no evidence was obtained that the acids are resolvable into enantiomorphously related components.—Acetylketen: a polymeride of keten: F. **Chick** and N. T. M. **Wilsmore.**—Saponification of ethyl formate by water in presence of acids as catalytic agents: A. **Lap-**

worth.—The triazo-group, part iii., bistriazo-derivatives of ethane and of acetic ester: M. O. **Forster**, H. E. **Fierz**, and W. P. **Joshua.**

Physical Society, April 10.—Dr. C. Chree, F.R.S., president, in the chair.—An experimental investigation of the nature of γ rays: Prof. W. H. **Bragg** and Mr. **Madsen.** The view that the γ rays are not ether pulses, but are material and consist of neutral pairs of one negative with one positive electron, developed in previous papers (*Phil. Mag.*, October, 1907), is held to be established by the experiments described in this paper with the secondary radiation produced by the γ rays of radium.—Experiments on artificial fulgurites: Miss D. D. **Butcher.** The first part of the paper deals with natural fulgurites, and the second with the production of artificial fulgurites. The experiments show:—(1) The tubes are formed by fusion of the powder which surrounds the column of air in which the spark passes. The length and thickness of the tube depend on the energy of the spark, and also on the character of the spark, *i.e.* whether it is unidirectional or oscillatory. (2) There is no appreciable difference in the two ends of a tube provided that the two electrodes are alike. When one electrode is a point and the other a flat plate, any branching that may occur will be towards the plate, whichever electrode is made positive. In nature, the flat plate would be represented by the moist lower strata of the soil. Therefore we cannot say from the character of the tube whether the lightning discharge was from a positive or negative cloud. (3) The difference between thick and thin tubes is due probably to a difference in the sharpness of the flash and the resulting explosive effect. When the explosive effect is great and the quantity of material melted is small, the result will be a large-bored, thin-walled tube. Whether this remains circular or becomes pressed together and distorted depends merely on whether the fused matter has time to cool before the outward pressure of the blowing has been overcome by the inward pressure on the surrounding sand or not. In nature, the damp sand or soil probably acts as the damp string in these experiments, and consequently causes many lightning discharges to be unidirectional. In the experimental tubes the outward pressure was so great, and the quantity of fused material so small, that the walls were broken through and left as a mere network.—Short-spark phenomena: W. **Duddell.** The paper deals with two effects which the author has observed in connection with some measurements of the current in the secondary circuit of an induction-coil. The apparatus in use consisted of a 12-inch Newton induction-coil, which was supplied from the 200-volt direct-current mains. A large resistance was placed in series with the primary of the coil to limit the current, and the current was interrupted by means of a mercury-jet interrupter. The secondary circuit contained a galvanometer to measure the mean current, and a thermo-ammeter to measure the root mean squared current. When there was no spark-gap in the secondary circuit and the coil was in action, the mean current, as read by the galvanometer, was zero, and the root mean squared current about 3·8 milliamperes. If, now, a microscopic spark-gap, say between two aluminium points, was introduced into the secondary circuit, two curious effects took place. Firstly, the R.M.S. current enormously increased in value, and, secondly, a very large deflection was produced on the galvanometer in the direction corresponding to that due to making the primary circuit. The introduction of a spark-gap 1/10 mm. long caused the R.M.S. current to rise to 38·5 milliamperes, and this continued to increase with increasing length of spark-gap until it reached a maximum with a gap about 1·4 mm. The author thinks that this effect is due to very high frequency oscillations set up in the wires connected to the secondary circuit of the coil when a spark-gap is introduced. He has observed the effect with brass, iron, zinc, and aluminium electrodes, but the latter metal is the best to use.

Mathematical Society, April 30.—Prof. W. Burnside, president, in the chair.—A general convergence theorem and the theory of the representation of a function by a series of normal functions: Dr. E. W. **Hobson.** A general convergence theorem is established, which, when applied to series of Sturm-Liouville functions, suffices to show that the question whether the series converges, or not, at a particular point, depends only upon the nature of the function in an arbitrarily small neighbourhood of the point, whilst the nature of the function throughout the whole interval of representation is restricted only by the condition that it must possess a Lebesgue integral in the interval. The theorem is further employed to show that, subject to the same condition as regards the nature of the function, the question whether the series converges uniformly, or not, in an interval in which the function is continuous, depends only upon the nature of the function in an interval which encloses the interval of continuity in its interior, exceeding it in length by an arbitrarily small amount.—The ordering of the terms of polars and transvectants: L. **Isserlis.** Between any two non-adjacent terms T_1, T_2 of a polar or a transvectant a series of terms $T_{1,1}$, $T_{1,2}$, . . . $T_{1,i}$ can be placed so that any term in the series T_1, $T_{1,1}$, . . . $T_{1,i}$, T_2 shall be adjacent to the terms on either side of it. In the paper a method is developed for actually ordering all the terms in this way.—Oscillating successions of continuous functions: Dr. W. H. **Young.** The paper deals with the theory of series which neither converge nor diverge to a definite limit. In such cases the sum function is replaced by two functions, the upper and lower functions of a sequence. The theory of uniform convergence and divergence is extended to series of functions which oscillate at every point.—The relation between the convergence of series and integrals: T. J. I'A. **Bromwich.** It is proved that when $\phi(x)$ tends steadily to infinity, as x increases, but more slowly than x, the behaviour of the integrals

$$\int^{\infty} f(x) \sin \phi(x) dx, \quad \int^{\infty} f(x) \cos \phi(x) dx,$$

determines the character of the series

$$\sum^{\infty} f(n) \sin \phi(n), \quad \sum^{\infty} f(n) \cos \phi(n).$$

—The multiplication of series: G. H. **Hardy.**—Porisms: H. **Bateman.**—The influence of viscosity on wave motion: W. J. **Harrison.**—Informal communications were made as follows:—(1) Mersenne's numbers; (2) Quartans with numerous quartan factors: Lieut.-Colonel A. **Cunningham.** In the first a factor 150287 was reported of the number $2^{163}-1$. This result reduces to 18 the number of Mersenne's numbers (of the form 2^q-1) which have not yet been verified, and none of these 18 numbers contains any factor less than 200,000. In the second it was shown how to construct numbers of the form x^4+y^4 which shall have any desired number of divisors of the same form.

PARIS.

Academy of Sciences, April 27.—M. H. Becquerel in the chair.—A problem relating to the theory of left-handed curves: Gaston **Darboux.**—The application of wireless telegraphy to the improvement of meteorological warnings: G. **Bigourdan** (see p. 14).—The zoological relations of the shrimps of the order of Stenopidæ: E. L. **Bouvier.**—Entropy: M. **Auric.** An expression for entropy derived from the density of the ether, assuming its pressure to represent the absolute temperature.—The ionisation of air by ultra-violet light: Eugène **Bloch.** On repeating the original experiments of Lenard, it was found that the greater part of the Lenard effect could be traced to the presence of particles in the gas. When the gas is completely freed from dust, the Lenard effect, if it exists, represents only a small fraction of the effect due to the dust.—The velocity of transport of the ions H, Cl, and OH in the electrolysis of solutions of hydrochloric acid: E. **Doumer.** From the experiments described the author concludes that the ionisation of water takes an active part in the electrolysis of solutions of hydrochloric acid, and the velocity of transport of the Cl and H ions is sensibly the same.—The detection of helium in minerals containing uranium: F. **Bordas.** The method described in a previous paper (selective absorption with charcoal at low temperatures) has been applied to numerous minerals containing uranium. Its delicacy is sufficient to detect helium in 1 milligram to 2 milligrams of brøggerite, liebigite, or æschynite. Minerals containing

definite crystallised uranium compounds, such as torbernite, autunite, and Californian carnotite, give no helium. A list of minerals containing uranium in which helium has been detected is given.—The direct use of copals in the manufacture of varnish without a preliminary heating: Ach. **Livache.** The necessity for preliminary heating of the copal, with its accompanying loss, can be avoided by using amyl alcohol containing some tenths per cent. of acid as the solvent.—The levers in the organism: Aug. **Michel.**

CALCUTTA.

Asiatic Society of Bengal, April 1.—Skull of a gigantic ray of the genus Ceratoptera: Captain R. E. **Lloyd.** The specimen was cast ashore at Puri, on the Orissa coast, and forms the type of a new species. The genus does not appear to have been recorded hitherto from Indian seas.—Fresh-water sponges from the Bombay Presidency and Burma: Dr. N. **Annandale.** The two collections were made in November, 1907, in the Western Ghats, and in March, 1908, at Rangoon and the Amherst district of Tenasserim. The Bombay collection includes several species originally described by Carter from that Presidency, as well as others new to science, not hitherto known from India, or only recorded from Bengal.

DIARY OF SOCIETIES.

THURSDAY, MAY 7.

ROYAL SOCIETY, at 4.—Election of Fellows.—At 4.30.—Helium and Radioactivity in Rare and Common Minerals: Hon. R. J. Strutt, F.R.S.—The Action of Resin and Allied Bodies on a Photographic Plate in the Dark: Dr. W. J. Russell, F.R.S.—Seleno-aluminium Bridges: Prof. G. M. Minchin, F.R.S.—A Tantalum Wave-detector, and its Application in Wireless Telegraphy and Telephony: L. H. Walter.

ROYAL INSTITUTION, at 3.—Mendelian Heredity: William Bateson, F.R.S.

CHEMICAL SOCIETY, at 8.30.—The Interaction of Diazonium Salts with Mono- and Di-hydric Phenols and with Na hthols: K. J. P. Orton and R. W. Everatt.—The Condensation of Benzoin with Methyl Alcohol: J. C. Irvine and D. McNicoll.—The Mutual Solubility of α-Methylpiperidin and Water: O. Flaschner and B. MacEwen.—The Melting Points of the Anilides, *p*-Toluidides, and α-Naphthylamides of the Normal Fatty Acids: P. W. Robertson.—The Refraction and Dispersion of Triazo-compounds: J. C. Philip.—The Dissociation Constants of Triazoacetic and α-Triazopropionic Acids: J. C. Philip.—The Absorption Spectrum of Camphor: W. N. Hartley.—The Viscosity of Solutions: C. E. Fawsitt.—The Action of Fused Potassium Hydroxide and of Hydrogen Peroxide on Cholesterol, Preliminary Note: R. H. Pickard and J. Yates.—The Fermentation of Mannose and Fructose by Yeast Juice, Preliminary Communication: A. Harden and W. J. Young.—The Volumetric Estimation of Silver: W. R. Lang and J. O. Woodhouse.—The Constituents of Olive Leaves: F. B. Power and F. Tutin.—The Constituents of Olive Bark: F. B. Power and F. Tutin.

LINNEAN SOCIETY, at 8.—Colony-formation as a Factor in Organic Evolution: H. M. Bernard.—Antipatharia from the Voyage of H.M.S. *Sealark*: C. Forster-Cooper.—A List of the Fresh-water Fishes, Batrachians, and Reptiles obtained by Mr. J. Stanley Gardiner's Expedition to the Indian Ocean: G. A. Boulenger, F.R.S.—A Cinematographic Representation of the Movements of Peripatus and other Invertebrate Animals: F. Martin Duncan.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY, at 8.—Abbreviated Formulæ for Structural Engineers: E. Fiander Etchells.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Manufacture of Electrical Condensers: G. F. Mansbridge.

FRIDAY, MAY 8.

ROYAL INSTITUTION, at 9.—Ice and Its Natural History: J. Y. Buchanan, F.R.S.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Theory of the Motion of the Moon; containing a New Calculation of the Expressions for the Coordinates of the Moon in Terms of the Time: Prof. E. W. Brown.—The Proper Motion of Small Stars: S. W. Burnham.—Second Index Catalogue of Nebulæ and Clusters of Stars found in the Years 1805 to 1907: J. L. E. Dreyer.—Results of Micrometer Observations of Double Stars made with the 28-inch Refractor in the Year 1907: Royal Observatory, Greenwich.—*Probable Papers*: An Empirical Law of Astronomical Refraction: Prof. H. H. Turner.—On the Practical Testing of Concave Parabolic Mirrors: Rev. C. D. P. Davies.

PHYSICAL SOCIETY, at 8.—A Modified Theory of Gravitation: Dr. C. V. Burton.—An Examination of the Formulæ for the Grading of Cables: C. S. Whitehead.—Illustrations of Geometrical Optics: R. M. Archer.

SATURDAY, MAY 9.

ROYAL INSTITUTION, at 3.—Chile and the Chilians: G. F. Scott Elliot.

MONDAY, MAY 11.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Geographical Conditions and Railway Construction in the Balkan Peninsula: Noel Buxton.

TUESDAY, MAY 12.

ROYAL INSTITUTION, at 3.—Why Light is believed to be a Vibration: Prof. F. T. Trouton, F.R.S.

ZOOLOGICAL SOCIETY, at 8.30.

FARADAY SOCIETY, at 8.—The Industrial Uses of Ozone in Connection with Water Purification: F. Mollwo Perkin.—Determination of Boiling Points of very small Quantities of Liquids: L. O'Dowd and F. Mollwo Perkin.—An Apparatus for Measuring Dielectric Constants of Non-conducting Liquids: Dr. Veley, F.R.S.

WEDNESDAY, MAY 13.

ROYAL SOCIETY OF ARTS, at 8.—The Underground Water Supplies of the Thames Basis: Clayton Beadle.

THURSDAY, MAY 14.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: The Structure of the Central Nervous System of the Higher and Lower Animals: Prof. Gustaf Retzius, For.Mem.R.S.

ROYAL INSTITUTION, at 3.—Mendelian Heredity: W. Bateson, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—On the Invariants of the General Linear Homographic Transformation in Two Variables: Major P. A. MacMahon.—On the Order of the Group of Isomorphisms of an Abelian Group: H. Hilton.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Switch Gear Control Apparatus and Relays for Alternating-current Circuits: Dr. C. C. Garrard.

IRON AND STEEL INSTITUTE, at 10.30 a.m.—On Improvements in Plate Rolling Mills: A. Lamberton.—On the Physical Qualities of Steel in Relation to its Mechanical Treatment: J. E. York.—On a New Fatigue Test for Iron and Steel: Dr. T. E. Stanton.—On an Experimental Electric Furnace for the Smelting of Iron: Prof. B. Igewsky.

FRIDAY, MAY 15.

ROYAL INSTITUTION, at 9.—The Past and Future of Tuberculosis: H. T. Bulstrode.

IRON AND STEEL INSTITUTE, at 10.30 a.m.—On Cast Iron in the Construction of Chemical Plant: F. J. R. Carulla.—On the Application of Colour Photography to Metallography: E. F. Law.—On the Utilisation of Blast-Furnace Slag for Portland Cement: C. von Schwarz.—On the Department of Metallurgical Chemistry in the National Physical Laboratory: W. Rosenhain.—On the Pyrometric Installation of the Ordnance Factories, Woolwich: J. Wesley Lambert.

ROYAL SOCIETY OF ARTS, at 8.—The Dangers of Coal Dust and their Prevention: W. E. Garforth.

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